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EUROPEAN PATENT OFFICE

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Patent Abstracts of Japan

PUBLICATION NUMBER : 09288997
PUBLICATION DATE : 04-11-97

APPLICATION DATE : 23-04-96
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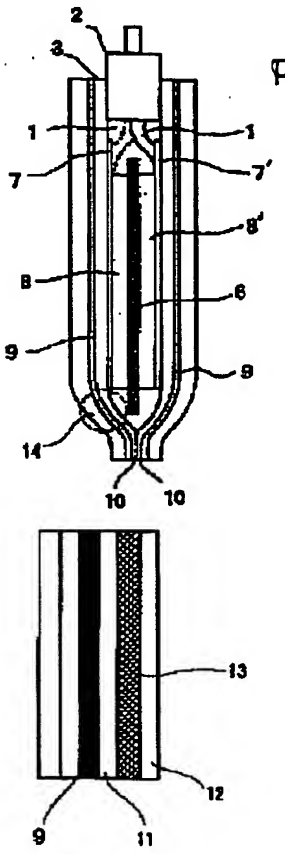
APPLICANT : SUMITOMO ELECTRIC IND LTD;

INVENTOR : TANAKA KEIICHI;

INT.CL. : H01M 2/02 H01M 2/30 H01M 10/40

TITLE : SEALING BAG FOR NONAQUEOUS ELECTROLYTE BATTERY



ABSTRACT : PROBLEM TO BE SOLVED: To keep sealing reliability despite using at high temperature, by providing an insulating layer, excellent in an electrolyte barrier, between the heat sealing plastic layer of the innermost layer of an sealing bag and a metallic layer.

SOLUTION: A sealing bag 3 is manufactured by fusing the insulator 12 of the innermost layer on the inner side of the sealing bag, for housing positive and negative electrodes, a partioning coat, and an electrolyte, and being contacted directly. The sealing bag and a lead wire are integrated, by fusing the insulator 12 of the sealing bag and the insulator 2 of the outermost layer of the lead wire; and the lead wire is drawn out outside, and while is connected to the positive and negative electrodes respectively in the inside of the sealing bag. Here, by providing an insulating layer 13, excellent in an electrolyte barrier, between the heat sealing plastic layer 12 of the innermost layer and the aluminium foil 9 of a metallic layer, the infiltration of an electrolyte, between the metallic layer 9 and the insulator of a metallic adhesive layer, can be restrained, to prevent peeling between the metallic layer and the metallic adhesive layer, thereby obtaining high airtightness, despite in a case where the sealing bag is retained at a high temperature of 85°C.

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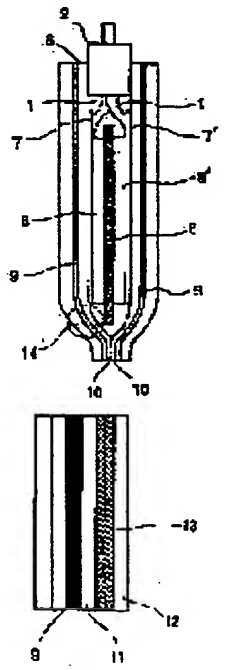
(71)Applicant : SUMITOMO ELECTRIC IND LTD
(72)Inventor : FUKUDA YUTAKA
HANABUSA KOJI
TANAKA KEIICHI

(54) SEALING BAG FOR NONAQUEOUS ELECTROLYTE BATTERY

(57)Abstract:
PROBLEM TO BE SOLVED: To keep sealing reliability despite using at high temperature, by providing an insulating layer, excellent in an electrolyte barrier, between the heat sealing plastic layer of the innermost layer of an sealing bag and a metallic layer.
SOLUTION: A sealing bag 3 is manufactured by fusing the insulator 12 of the innermost layer on the inner side of the sealing bag, for housing positive and negative electrodes, a partioning coat, and an electrolyte, and being contacted directly. The sealing bag and a lead wire are integrated, by fusing the insulator 12 of the sealing bag and the insulator 2 of the outermost layer of the lead wire; and the lead wire is drawn out outside, and while is connected to the positive and negative electrodes respectively in the inside of the sealing bag. Here, by providing an insulating layer 13, excellent in an electrolyte barrier, between the heat sealing plastic layer 12 of the innermost layer and the aluminium foil 9 of a metallic layer, the infiltration of an electrolyte, between the metallic layer 9 and the insulator of a metallic adhesive layer, can be restrained, to prevent peeling between the metallic layer and the metallic adhesive layer, thereby obtaining high airtightness, despite in a case where the sealing bag is retained at a high temperature of 85°C.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] A positive electrode, a negative electrode, and the electrolytic solution are enclosed with an enclosure bag, and this invention each relates the lead wire of a positive electrode and a negative electrode to the enclosure bag for nonaqueous electrolyte cells which has the structure taken out outside and has the structure where the reliability about seal of the electrolytic solution is high.
[0002]
[Description of the Prior Art] The demand to the miniaturization of the cell as a power supply and lightweight-izing has become strong with the miniaturization of electronic equipment. On the other hand, the formation of high-energy density and high-energy increase in efficiency are also called for, and the expectation for rechargeable batteries, such as a lithium ion battery, is growing. As opposed to such a demand, a group of electrode is inserted in the bag which consists of thermoplastics which has acid resistance, and the attempt which wraps a majority of this group of electrode in the saccate sheathing object which consists of the shape of a film, the shape of a sheet, and tube-like synthetic resin, and uses it as a sealed type lead accumulator is proposed so that JP,61-240564,A may see.
[0003] Moreover, it lessens "carry out heat weld" as much as possible, and a miniaturization is attained, heat enclosure of the lead-wire metal is not carried out at a direct plastics bag, but the attempt using what carried out resin covering is beforehand proposed by lead wire so that JP,56-71278,A may see. [of a sheet-like dc-battery]
[0004] Moreover, the attempt which improves sealing performance between the films of plastics as structure whose metal layer was pinched is also in the sheet of an enclosure bag so that JP,3-62447,A and JP,57-115820,A may see.
[0005]
[Problem(s) to be Solved by the Invention] If it was in the cell of the type enclosed with the conventional enclosure bags, such as JP,61-240564,A, since it took out outside by having used some metals of an electrode as the pole pillar and this was used for connection with the exterior, misgiving remained in the sealing performance in the seal section of this metal.
[0006] JP,56-71278,A makes connection with the exterior carry out heat weld of covering of lead wire, and the plastics in a bag using what connected with the electrode the lead wire which carried out resin covering beforehand for the purpose of making this misgiving cancel, and is improving sealing performance. By the nonaqueous electrolyte cell for which the enclosure bag used the organic solvent although this method was effective only in the case of plastics, in a plastics simple substance, in order that the electrolytic solution may penetrate, and it may volatilize or moisture may permeate from the exterior, when airtightness is bad, for example, applies to a lithium ion battery etc., there is a problem of service capacity falling quickly with advance of a cycle.
[0007] Therefore, the attempt for which metal layers, such as a metallic foil metallurgy group vacuum evaporationo layer, are used for an enclosure bag in the sheet inserted in between is seen by JP,3-62447,A and JP,57-115820,A. As for these, acrylic-acid conversion polyethylene, the acrylic-acid conversion polypropylene ionomer, etc. are used for the heat-sealing layer. In this composition, high airtightness is accepted in ordinary temperature. However, when it carries in electronic equipment, for example, a personal computer, in recent years, resistance with a high temperature of 85 degrees C is demanded, with these composition, in the high temperature of 85 degrees C, the acrylic-acid conversion polyethylene of a metal layer and a metal-bonding layer and an acrylic-acid conversion polypropylene ionomer exfoliate, and there is a problem to which airtightness falls.
[0008]
[Means for Solving the Problem] By examining many things about the aforementioned technical problem, and preparing the insulating layer which was excellent in electrolytic-solution barrier property between the plastics layer for heat sealing of the innermost layer of an enclosure bag, and the metal layer, this invention person etc. suppressed the invasion of a between [the metal layer of the electrolytic solution, and a metal-bonding layer], prevented ablation of a metal layer and a metal-bonding layer, found out that high airtightness was acquired also on conditions with an elevated temperature of 85 degrees C, and carried out this invention.
[0009] Hereafter, this invention is explained in detail using drawing. As a positive electrode, a negative electrode, a diaphragm, and the electrolytic solution are contained as shown in drawing 2 , and an enclosure bag is shown in drawing 3 and drawing 4 , the enclosure bag is produced by welding the insulator 12 of the innermost layer inside [which contacts directly] an enclosure bag. An enclosure bag and lead wire are unified by welding the insulator 12 of an enclosure bag, and the insulator 2 of the outermost layer of drum of lead wire, lead wire is taken out outside, and lead wire is connected to the plate of positive and a negative electrode in the interior of an enclosure bag, respectively. It connects beforehand and lead wire and an electrode are enclosed with an enclosure bag.

[0010] A positive electrode and a negative-electrode plate have the structure where the active material layer was formed on metal bases, such as a metallic foil called charge collector and an expanded metal. Although not limited especially about the connection method of lead wire, a positive electrode, and a negative-electrode plate, the method of connecting the metal base of this plate and the conductor of lead wire by spot welding, ultrasonic welding, etc. can use preferably.
[0011] this lead wire -- in the quality of the material of a conductor, the thing of the quality of the material which very high potential does not dissolve in positive-electrode connection with high potential for this reason is desirable Therefore, the alloy of aluminum, titanium, or these metals can use preferably. The thing of the quality of the material which a configuration is for changing by the surcharge when the lithium deposited, or potential is high and a lithium deposits from a bird clapper in an overdischarge, namely, cannot form a lithium and an alloy in negative-electrode connection easily, and is comparatively hard to dissolve with high potential is desirable. From the above viewpoint, the alloy of nickel, copper, or these metals can use for the quality of the material of a conductor preferably.
[0012] the configuration of a conductor -- a round shape and a straight angle, although the single track of a conductor can use preferably Since the thickness of the lead wire inserted between the insulators 12 of the innermost layer of an enclosure bag since a round diameter becomes large when cell capacity is large becomes large in a round case There is a problem to which it becomes easy to produce a gap in the weld section of the insulator 2 of the outermost layer of drum of lead wire and the insulator 12 of the innermost layer of an enclosure bag, and the reliability of sealing in the weld section of lead wire and an enclosure bag becomes low. it -- receiving -- a straight angle -- since the cross section can be earned by enlarging width of face, without enlarging thickness of a conductor also to the increase in cell capacity when a conductor is used, the fall of reliability to sealing of the weld section with the insulator 2 of the lead wire inserted between the insulators 12 of the innermost layer of an enclosure bag is not started furthermore, the external circuit using FPC (flexible printed circuit board) etc. and connection with an electrode plate -- also setting -- a straight angle -- the direction of a conductor has a large touch area and becomes possible [making more reliable connection] by spot welding or ultrasonic welding
[0013] It is made to rival, an enclosure bag has a desirable thing using material with the plastics in which metallic foil metallurgy group vacuum evaporationo layers, such as aluminum foil, etc. were inserted in the shape of sandwiches, and inside plastics at least needs not to dissolve in an electrolyte.
[0014] As the feature of this invention is shown in drawing 4 which is the enlarged view of the cross section of an enclosure bag furthermore, between the plastics layer 12 for heat sealing of an innermost layer, and the metal layer 9 By forming the insulating layer 13 excellent in electrolytic-solution barrier property, when it holds in elevated temperature of 85 degrees C, it can be suppressed that the electrolytic solution permeates between the insulators of the metal layer 9 and a metal-bonding layer, ablation between a metal layer and a metal-bonding layer is prevented, and high airtightness is acquired.
[0015] Although the insulating layer excellent in electrolytic-solution barrier property will not be limited especially if airtightness is held under elevated-temperature maintenance conditions of 85 degrees C, polyamide resin, such as nylon, an ethylene vinyl alcohol copolymerization resin, etc. can use it preferably.
[0016]
[Example] It carried out, and it went inside, the acid conversion LDPE side was united [the composition shown in Table 1 made it rival, two sheets were cut to the 70mmx135mm rectangle,] with it, three sides of rectangular circumferences were heat sealed by 5mm width of face, and it considered as the saccate.
[0017]
[Table 1]

表１　封入袋のシートの構成

実施例１	実施例２	比較例１	比較例２
PET(12μm)	PET(12μm)	PET(12μm)	PET(12μm)
酸変成LDPE(15μm)	酸変成LDPE(15μm)	酸変成LDPE(15μm)	酸変成LDPE(15μm)
ｱﾙﾐﾆｳﾑ(10μm)	ｱﾙﾐﾆｳﾑ(10μm)	ｱﾙﾐﾆｳﾑ(10μm)	ｱﾙﾐﾆｳﾑ(10μm)
酸変成LDPE(50μm)	ﾅｲﾛﾝ6(25μm)	酸変成LDPE(100μm)	ｱｸﾘﾙ酸変成PE*(100μm)
ｴﾁﾚﾝﾋﾞﾆﾙｱﾙｺｰﾙ共重合体(20μm)	酸変成LDPE(50μm)		
酸変成LDPE(50μm)			

[0018] On the other hand, after mixing the graphite 10 weight section and the polyvinylidene-fluoride 10 weight section in the LiCoO2 powder 100 weight section and dissolving in it at a N-methyl-2-pyrrolidone, it was made the shape of a paste. Next, coating of this paste was carried out to one side of aluminum foil with a thickness of 20 micrometers, and it carried out the roller press after dryness. Thus, the plate (5mm is the non-coating section) with the thickness of 0.1mm, a width of face [of 50mm], and a length of 105mm was produced, and it considered as the positive electrode.
[0019] Moreover, after mixing the polyvinylidene-fluoride 20 weight section in the Lynn-like natural-graphite powder 100 weight section and dissolving in it at a N-methyl-2-pyrrolidone, it was made the shape of a paste. Coating of this paste was carried out to both sides of copper foil with a thickness of 20 micrometers, and it carried out the roller press after dryness. Thus, the plate (5mm is the non-coating section) with the thickness of 0.10mm, a width of face [of 50mm], and a length of 105mm was produced, and it considered as the negative electrode.
[0020] Next, ultrasonic welding of the aluminum which is the conductor of lead wire was carried out to the portion of the

aluminum foil with which the active material of a positive electrode is not formed. Similarly, ultrasonic welding of the copper which is the conductor of lead wire was carried out to the portion of the copper foil in which the active material of a negative electrode is not formed.

[0021] The two electrodes which connected lead wire to the enclosure bag by the composition of the aforementioned example, respectively were inserted in the state where the diaphragm of the porous membrane of a polyolefine system has been arranged, between two electrodes, and eight cc of electrolytic solutions was poured in continuously. In addition, ethylene carbonate and diethyl carbonate were mixed in the electrolytic solution at the rate of a volume ratio of 1:1, and what dissolved the 6 fluoride [phosphoric-acid] lithium so that it might become in mol [1 / // l. and] was used for it.

[0022] It changed into the state of taking out lead wire from the opening portion of an enclosure bag after an appropriate time, and the insides of an insulation of lead wire, the inside of an enclosure bag, and the opening portion of an enclosure bag were heat sealed at 150 degrees C (seal width of face of 10mm). The examination cell was completed with the above procedure.

[0023]

[Effect of the Invention] the effect of this invention -- as follows -- constant temperature -- it checked by the test Moisture density measurement in the solvent by the Karl Fischer technique was performed, and electrolyte barrier property was estimated as the weight change after holding the cell produced as mentioned above by the 85-degree C thermostat for 720 hours.

[0024] In the example 1 of comparison, by the example 2 of comparison, aluminum foil, aluminum foil, and the pasted-up acid conversion LDPE exfoliated in 410 hours, and, 720 hours after, the solvent almost disappeared for 340 hours. In examples 1 and 2, as for aluminum foil, aluminum foil, and ablation with the pasted-up acid conversion LDPE, the amount of electrolyte volatilization was not accepted at all at 2.5% and 2.4% in no less than 720 hours, respectively.

[0025] Although resistance with an elevated temperature of 85 degrees C was not acquired in the examples 1 and 2 of comparison as mentioned above, 85-degree C resistance has been checked in the examples 1 and 2 which prepared the insulating layer excellent in electrolyte barrier property.

[0026] Furthermore, an example 1 and the cell of the composition of two are produced and it is a book. That is, change of the service capacity accompanying advance of the cycle when carrying out a charge-and-discharge cycle examination was investigated in the range of current density 0.4 mA/cm 2, 2.75-4.1V. About examples 1 and 2, 82% and 79% are maintained to service-capacity 125mAh at the time of initial 10 cycle, and 123mAh at the 300 cycle time, respectively, and it can be said that the effect of the airtight goodness of the cell using the enclosure bag of this invention is shown.

[Translation done.]

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CLAIMS

[Claim(s)]
[Claim 1] The enclosure bag for nonaqueous electrolyte cells characterized by preparing the insulating layer which a positive electrode, a negative electrode, and the electrolytic solution were enclosed with the enclosure bag, and are each the enclosure bag for the nonaqueous electrolyte cells of structure taken out outside, and the lead wire of a positive electrode and a negative electrode was made to rival a metal layer, plastics, etc., consisted of sheets, and was excellent in electrolytic-solution barrier property between the plastics layer for heat sealing of an innermost layer, and the metal layer.
[Claim 2] The enclosure bag for nonaqueous electrolyte cells of the claim 1 characterized by the insulating layers excellent in electrolytic-solution barrier property being nylon and an ethylene vinyl alcohol copolymer.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The example of the nonaqueous electrolyte cell using the enclosure bag of this invention is shown.
[Drawing 2] The interior of the enclosure bag of the nonaqueous electrolyte cell using the enclosure bag of this invention is shown typically.
[Drawing 3] The cross section of the nonaqueous electrolyte cell using the enclosure bag of this invention is shown.
[Drawing 4] The enlarged view of the cross section (14 portions of drawing 3) of the enclosure bag of this invention is shown.
[Description of Notations]
1 1': The conductor of lead wire
2 2': An insulation of lead wire
3: Enclosure bag
4: The seal portion of an enclosure bag
5 5': Electrode
6: Diaphragm
7: Aluminum of an electrode
8: Electrode active material
9: Aluminum foil
10: The plastics layer for heat sealing
11: Low melting point plastics layer
12: The plastics layer for heat sealing
13: The insulating layer excellent in electrolyte barrier property
14: The enlarged view of this portion is shown in drawing 4 .

[Translation done.]

で確認した。以上のようにして作製した電池を８５℃の恒温槽で７２０時間保持した後の重量変化と、カールフィッシャー法による溶媒中の水分濃度測定を行い、電解質バリア性を評価した。

【００２４】比較例１では３４０時間、比較例２では４１０時間でアルミ箔とアルミ箔と接着している酸変成ＬＤＰＥが剥離し、７２０時間後には溶剤がほとんど消失した。実施例１，２においては、７２０時間にも電解質揮発量がそれぞれ２．５%，２．４%でアルミ箔とアルミ箔と接着している酸変成ＬＤＰＥとの剥離は全く認められなかった。

【００２５】以上のように比較例１，２では高温８５℃での耐性が得られないが、電解質バリア性に優れた絶縁層を設けた実施例１，２では８５℃での耐性が確認できた。

【００２６】更に、実施例１，２の構成の電池を作製し、本発明の効果を充放電サイクル試験により確認した。すなわち、電流密度０．４ｍＡ／ｃｍ²、２．７５～４．１Ｖの範囲で、充放電サイクル試験を実施した時のサイクルの進行に伴う放電容量の変化を調べた。実施例１，２に関しては、それぞれ３００サイクル時点で初期１０サイクル時の放電容量１２５ｍＡｈ，１２３ｍＡｈに対して８２%，７９%を維持しており、本発明の封入袋を用いた電池の気密性の良さの効果が示されているといえる。

【図面の簡単な説明】

【図１】本発明の封入袋を用いた非水電解質電池の例を示す。

【図２】本発明の封入袋を用いた非水電解質電池の封入袋の内部を模式的に示したものである。

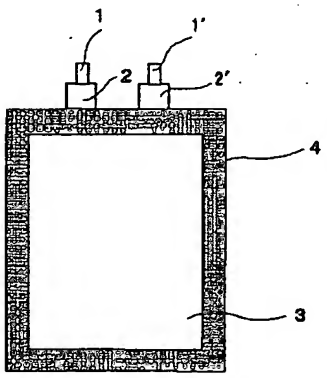
【図３】本発明の封入袋を用いた非水電解質電池の横断面を示す。

【図４】本発明の封入袋の断面（図３の１４の部分）の拡大図を示す。

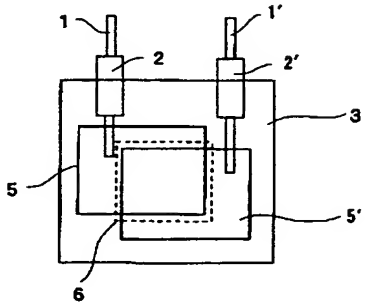
【符号の説明】

１，１′：リード線の導体
２，２′：リード線の絶縁
３：封入袋
４：封入袋のシール部分
５，５′：電極
６：隔膜
７：電極のアルミ
８：電極活物質
９：アルミ箔
１０：ヒートシール用プラスチック層
１１：低融点プラスチック層
１２：ヒートシール用プラスチック層
１３：電解質バリア性に優れた絶縁層
１４：この部分の拡大図を図４に示す

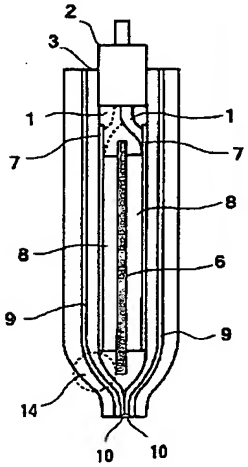
【図１】



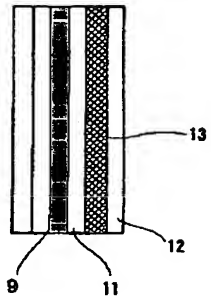
【図２】



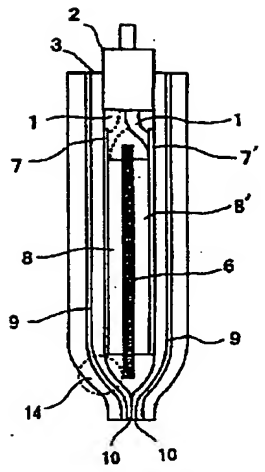
【図３】



【図４】



【手続補正書】
【提出日】平成９年１月２３日
【手続補正１】
【補正対象書類名】図面
【補正対象項目名】図３
【補正方法】変更
【補正内容】
【図３】



【手続補正２】
【補正対象書類名】明細書
【補正対象項目名】符号の説明
【補正方法】変更

【補正内容】
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２，２′：リード線の絶縁
３：封入袋
４：封入袋のシール部分
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６：隔膜
７：正極集電体
７′：負極集電体
８：正極活物質
８，８′：負極活物質
９：アルミ箔
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１１：低融点プラスチック層
１２：ヒートシールド用プラスチック層
１３：電解質バリア性に優れた絶縁層
１４：この部分の拡大図を図４に示す